

WHAT IS CLAIMED IS:

1. A gas concentration measuring apparatus comprising:
 - a gas sensor including a sensor base and a pump cell, the
 - 5 sensor base including a solid electrolyte body which defines within the sensor base a gas chamber into which gases are admitted through a given diffusion resistance, the pump cell being made up of a first and a second electrode affixed to the solid electrolyte body with the first electrode exposed to the gas chamber and responsive
 - 10 to application of electricity to the first and second electrodes to pump a given gas component out of and into the gas chamber selectively to produce a sensor signal in the form of an electrical change as a function of a pumped amount of the given gas component;
 - 15 an electricity control circuit working to produce a feeding signal having one of discrete electrical values to control the electricity applied to the first and second electrodes of the pump cell;
 - a sensor signal detecting circuit working to detect the
 - 20 sensor signal outputted from the pump cell and produce a sensor output as a function of concentration of the given gas component; and
 - a change limiting circuit working to limit a change in the sensor signal to within a given range.

2. A gas concentration measuring apparatus as set forth in claim 1, wherein said change limiting circuit is implemented by an integrating circuit which works to integrate the sensor signal.

5 3. A gas concentration measuring apparatus as set forth in claim 1, wherein said electricity control circuit works to determine a target value of the feeding signal as a function of the sensor signal.

10 4. A gas concentration measuring apparatus as set forth in claim 1, further comprising a second pump cell working to produce a pump signal as a function of concentration of the given gas component within a second gas chamber formed within said gas base downstream of the gas chamber, and wherein said electricity
15 control circuit works to determine a target value of the feeding signal as a function of the pump signal.

5. A gas concentration measuring apparatus as set forth in claim 1, wherein said electricity control circuit is designed to
20 produce a voltage modulated by a PWM signal and convert the modulated voltage into a DC voltage to be applied to the first and second electrodes of the pump cell.

6. A gas concentration measuring apparatus as set forth in
25 claim 5, wherein said electricity control circuit works to produce

the DC voltage within a range between binary voltage levels.

7. A gas concentration measuring apparatus as set forth in claim 6, wherein said electricity control circuit includes a
5 modulating circuit working to switch the voltage between the binary voltage levels using the PWM signal.
8. A gas concentration measuring apparatus comprising:
a gas sensor including a sensor base and a pump cell, the
10 sensor base including a solid electrolyte body which defines within the sensor base a gas chamber into which gases are admitted through a given diffusion resistance, the pump cell being made up of a first and a second electrode affixed to the solid electrolyte body with the first electrode exposed to the gas chamber and responsive
15 to application of electricity to the first and second electrodes to pump a given gas component out of and into the gas chamber selectively to produce a sensor signal in the form of an electrical change as a function of a pumped amount of the given gas component;
- 20 an electricity control circuit working to produce a feeding signal having one of discrete electrical values to control the electricity applied to the first and second electrodes of the pump cell;
- a sensor signal detecting circuit working to detect the
25 sensor signal outputted from the pump cell and produce a sensor

output as a function of concentration of the given gas component;
and

a blurring circuit working to blur a change in the sensor
signal.

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9. A gas concentration measuring apparatus as set forth in
claim 8, further comprising a change limiting circuit working to
limit the change in the sensor signal to within a given range prior
to blur the change in the sensor signal.

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10. A gas concentration measuring apparatus as set forth in
claim 8, wherein said blurring circuit is implemented by an
integrating circuit which works to integrate the sensor signal.

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11. A gas concentration measuring apparatus as set forth in
claim 8, wherein said electricity control circuit works to determine
a target value of the feeding signal as a function of the sensor
signal.

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12. A gas concentration measuring apparatus as set forth in
claim 8, further comprising a second pump cell working to produce
a pump signal as a function of concentration of the given gas
component within a second gas chamber formed within said gas
base downstream of the gas chamber, and wherein said electricity
25 control circuit works to determine a target value of the feeding

signal as a function of the pump signal.

13. A gas concentration measuring apparatus as set forth in claim 8, wherein said electricity control circuit is designed to
5 produce a voltage modulated by a PWM signal and convert the modulated voltage into a DC voltage to be applied to the first and second electrodes of the pump cell.

14. A gas concentration measuring apparatus as set forth in
10 claim 13, wherein said electricity control circuit works to produce the DC voltage within a range between binary voltage levels.

15. A gas concentration measuring apparatus as set forth in claim 14, wherein said electricity control circuit includes a
15 modulating circuit working to switch the voltage between the binary voltage levels using the PWM signal.

16. A gas concentration measuring apparatus comprising:
a gas sensor including a sensor base and a pump cell, the
20 sensor base including a solid electrolyte body which defines within the sensor base a gas chamber into which gases are admitted through a given diffusion resistance, the pump cell being made up of a first and a second electrode affixed to the solid electrolyte body with the first electrode exposed to the gas chamber and responsive
25 to application of electricity to the first and second electrodes to

pump a given gas component out of and into the gas chamber selectively to produce a sensor signal in the form of an electrical change as a function of a pumped amount of the given gas component;

5 an electricity control circuit working to produce a feeding signal having one of discrete electrical values to control the electricity applied to the first and second electrodes of the pump cell;

 a sensor signal detecting circuit working to detect the
10 sensor signal outputted from the pump cell and produce a sensor output as a function of concentration of the given gas component; and

 a blurring circuit working to blur the feeding signal produced by said electricity control circuit.

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17. A gas concentration measuring apparatus as set forth in claim 16, wherein said blurring circuit is implemented by an integrating circuit which works to integrate the feeding signal.

20 18. A gas concentration measuring apparatus as set forth in claim 16, wherein said electricity control circuit works to determine a target value of the feeding signal as a function of the sensor signal.

25 19. A gas concentration measuring apparatus as set forth in

claim 16, further comprising a second pump cell working to produce a pump signal as a function of concentration of the given gas component within a second gas chamber formed within said gas base downstream of the gas chamber, and wherein said
5 electricity control circuit works to determine a target value of the feeding signal as a function of the pump signal.

20. A gas concentration measuring apparatus as set forth in claim 16, wherein said electricity control circuit is designed to
10 produce a voltage modulated by a PWM signal and convert the modulated voltage into a DC voltage to be applied to the first and second electrodes of the pump cell.

21. A gas concentration measuring apparatus as set forth in
15 claim 20, wherein said electricity control circuit works to produce the DC voltage within a range between binary voltage levels.

22. A gas concentration measuring apparatus as set forth in claim 21, wherein said electricity control circuit includes a
20 modulating circuit working to switch the voltage between the binary voltage levels using the PWM signal.